

# PATENT SPECIFICATION

(11) 1 570 001

001 (21) Application No. 16697/76 (22) Filed 23 Apr. 1976  
 570 (23) Complete Specification Filed 19 Apr. 1977  
 (44) Complete Specification Published 25 Jun. 1980  
 1 (51) INT. CL.<sup>3</sup> G02B 5/14  
 (52) Index at Acceptance  
 G2J EA EB  
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Biblioteca  
 Inv. Ind. Eigent.

4 JUL 1980

## (54) MANUFACTURING OPTICAL FIBRE CONNECTORS

(71) We, STANDARD TELEPHONES AND CABLES LIMITED, a British Company, of 190 Strand, London, WC2R 1DU England, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:

10 This invention relates to methods of making lens terminations for optical fibres. Our co-pending application No. 04174/76 (Serial No. 1569614) (M. Chown - 19) describes a variety of ball-lens terminations for terminating optical fibres and for optically coupling such fibres together. In particular that application describes an optical fibre termination for a clad fibre, including a whole or truncated substantially spherical lens, and means for mounting the lens adjacent the bared fibre end such that light emitted from the fibre end is refracted into a substantially parallel beam by the lens.

15 According to the present invention there is provided a process for manufacturing a lens termination for an optical fibre, including forming a plastics preform comprising a tube member with a coaxial bore and having one end closed by a lens at least the rearward portion of which comprises a plastics material, the bore and lens being arranged such that the base of the bore lies in the focal plane of the lens, directing light from a laser through the lens so as to focus the light on to the base of the bore thus evaporating a portion of the plastics material to form a cavity which, when the termination is in use, receives the bared end of a coated optical fibre.

20 An embodiment of the invention will now be described with reference to the drawing accompanying the Provisional Specification in which:-

25 Figure 1 shows a machined plastics blank.

30 Figure 2 shows the method of laser

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machining the fibre locating cavity in the blank.

Figure 3 shows a finished fibre termination, and

Figure 4 shows a Fresnels type combiner

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termination; and with reference to Figure 5 of the accompanying drawing which shows a longitudinal section of a termination fitted with a graded refractive index lens.

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Referring to Figures 1 to 3, a rod-shaped body of plastics, e.g. acrylic material is machined to form the blank shown in Figure 1 which comprises a plastics body 11 having a coaxial bore 12 and an integrated ball lens 13 closing one end of the bore. The bottom surface 14 of the bore 12 is arranged such that the focal point of the ball lens 13 lies in the plastics material just below the surface 14. Preferably the tolerance in the distance D (Figure 1) between the surface 14 and the pole 15 of the lens 13 should not exceed 10 microns.

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Figure 2 shows the method of laser machining the preform to prepare the finished termination. A parallel beam laser and lens assembly 21 is arranged so as to direct light parallel to the axis of the preform. The light is focuseed by the lens 13 to a point just below the surface 14 so that a small quantity of the plastics material is evaporated to form a well 31 (Figure 3). As the laser beam is parallel to the axis of the preform the well 31 is machined in the correct position for receiving a fibre end in the finished termination.

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The output wavelength or wavelengths of the laser should be chosen such that the light is fairly well absorbed by the plastics material. Alternatively the surface 14 may be treated with a light absorbing material.

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The termination is completed as shown in Figure 3 by the insertion in the bore 12 of a guide ring 32 which has a conical guide surface 33 for directing the fibre end into the

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well 31. In some applications this ring may be dispensed with and the conical surface 33 may then be formed integral with the plastics body 11.

5 This laser machining technique may also be employed with terminations in which the ball lens is replaced by a Fresnel lens. Such an arrangement is shown in Figure 4.

10 A plastics body member 41 is provided with first and second bores 42 and 43 each for receiving an optical fibre. The face 44 of the body member is formed into a double Fresnel's lens arrangement having first and second portions which focus on the ends of the first and second bores respectively. As before illumination of the Fresnel lens system by an axially aligned laser evaporates a cavity in each bore for receiving the bared end of the optical fibre.

15 20 In some applications the fibre termination, as shown in Figure 5, may employ a graded refractive index self focussing lens 51 the front surface 52 of which is provided with an antireflection coating. The physical length of the lens 52 is determined such that the lens focus lies outside the lens, but within a plastics coating 54 applied to the lens rear surface 55. A laser beam directed coaxial with the optical axis of the lens 25 evaporates a cavity 56 in the plastics coating 54 for receiving an optical fibre (not shown). The plastics coating is required with graded refractive index lenses as such lenses are normally made by fusing together several 30 different glasses. If, however, the lens is made of a plastics material the rear coating 54 may then be dispensed with.

35 40 The terminations described herein are suitable for use with plastics coated clad silica optical fibres, but may also be used with plastics coated glass, plastics, or unclad silica fibres.

WHAT WE CLAIM IS:

45 50 55 1. A process for manufacturing a lens termination for an optical fibre, including forming a plastics preform comprising a tube member with a coaxial bore and having one end closed by a lens, the bore and lens being arranged such that the base of the bore lies in the focal plane of the lens, directing light on to the base of the bore thus evaporating a portion of the plastics material to form a cavity which, when the termination is in use, receives the bared end of an optical fibre.

60 65 2. A process as claimed in claim 1, and in which said lens is a graded refractive index self focussing lens the rearward surface of which is coated with a layer of plastics material, and in which the cavity is formed in said layer.

3. A process as claimed in claim 1 and in which said lens is a plastics Fresnel lens.

4. A process for manufacturing a lens termination for an optical fibre, which

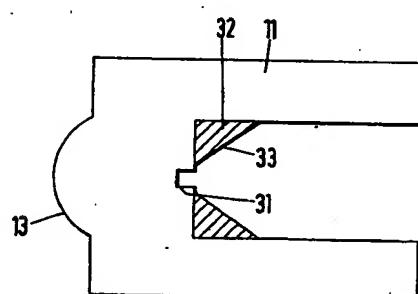
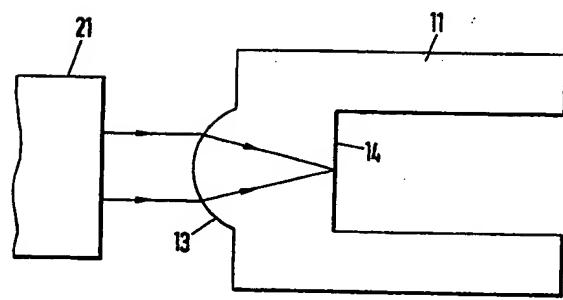
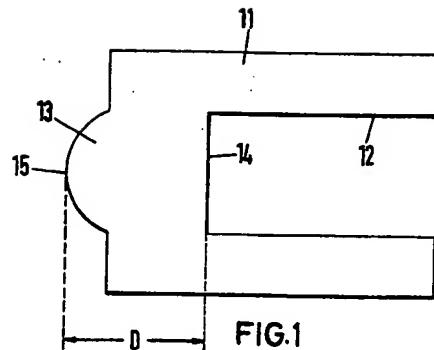
process is substantially as described herein with reference to Figures 1, 2 and 3 or to Figure 4 of the drawings accompanying the Provisional Specification, or to Figure 5 of the accompanying drawings.

70 5. An optical fibres lens termination when made by the method of any one of the preceding claims.

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Printed for Her Majesty's Stationery Office,  
by Croydon Printing Company Limited, Croydon, Surrey, 1980.  
Published by The Patent Office, 25 Southampton Buildings,  
London, WC2A 1AY, from which copies may be obtained.

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PROVISIONAL SPECIFICATION

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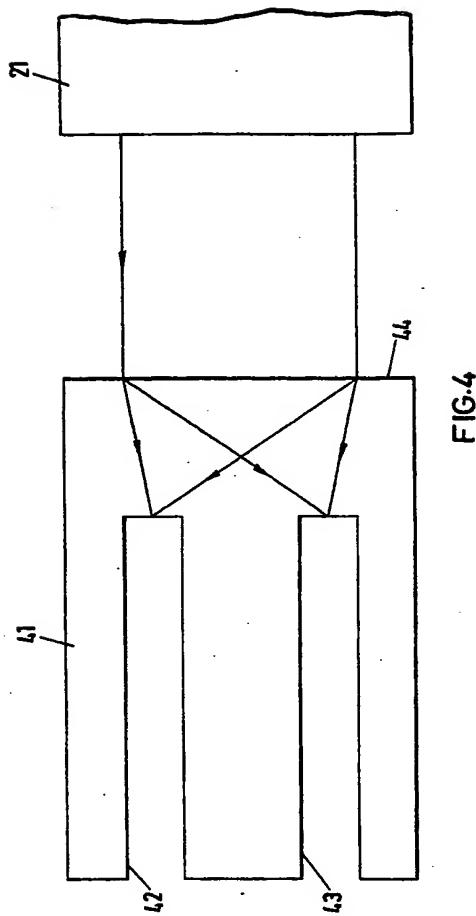


FIG.4

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COMPLETE SPECIFICATION

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FIG.5

